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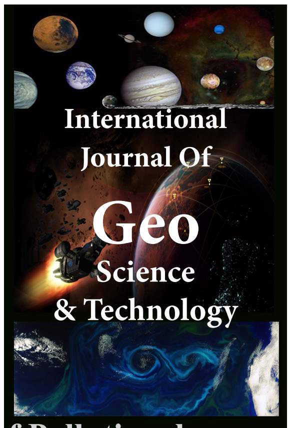

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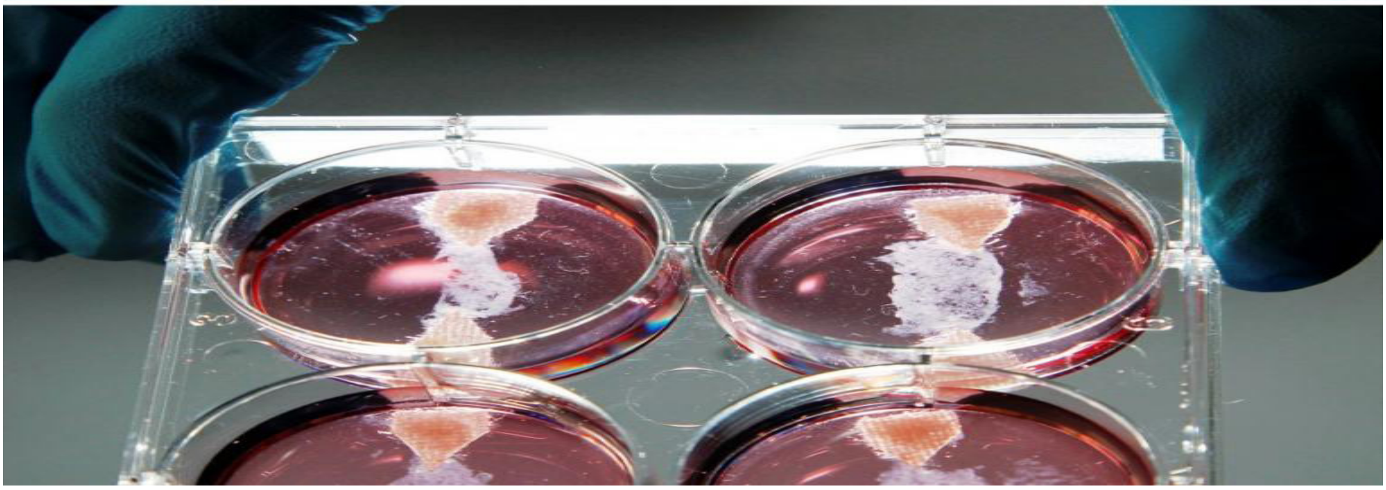

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EVALUATION OF POLLUTIONAL STATUS OF AMKHERA POND, (JABALPUR, M.P.) WITH THE HELP OF SHANNON'S DIVERSITY INDEX

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Abstract

The commonest cause of pollution is inadequately treated sewage discharged into rivers and lakes, which acts as ' biostimulants' and cause eutrophication. Polluted water affects fishery potential and acts as a reservoir of water borne diseases and number of parasitic zoonoses. Water pollution indices are commonly used for detection and evaluation of water pollution. The indices are broadly characterized into two parts – the physico chemical and biological indices. A physicochemical approach as well as biomonitoring was performed for a period of two years (March 2000 to Feb. 2002) for the ecobiological study of Amkhera pond. This paper deals with the biological monitoring of pond water at Amkhera village and estimation of zooplanktonic diversity during the study period. Calculated value of general diversity H (Shannon Index) for the year 2000-01 was 1.1682 and for the year 2001-02 was 1.1441. These values indicate the low species diversity as compared to clean water. The Shannon index so formulated indicates that higher the value, greater the diversity.

Key Words : Zooplankton, Species Diversity, Biological monitoring, Water pollution Index.

Pages:08 References:16

INTRODUCTION

Zooplankton can be listed as pollution indicators. The changes in physico-chemical condition of aquatic system can be reflected directly in the biotic community of ecosystem. The abundant species composition and condition of aquatic organisms in natural communities are directly related to the water quality. The biological status of water body has been expressed in terms of diversity by many researchers (Sinha and Roy, 1991; Dhamija and Jain, 1993; Kumar *et. al.*, 2002; Kesharwani *et. al.*, 2005).

Species Diversity Indices

According to Odum (1971), the ratios between the number of species and number of individuals (importance value) are called species diversity. Most natural water bodies contain few species, having a large number of individual per species, few species having moderate population and other represented by a few individuals. Pollution disturbs this relationship as the number of rare species decreases drastically and the number of few species which are tolerant to pollution, increases. This cause an imbalance in the system which could be monitored to detect the effect of pollution. This type of relationship is best represented by 'Diversity Indices'(a mathematical expression of species - importance relationship). Several types of indices are available (Pielou, 1924). Out of them, only Shannon's (1949) Index is described in this paper. The population data obtained after a detailed zooplanktonic study are used to calculate the diversity index.

MATERIAL AND METHODS

Amkhera pond is one of the pond of Jabalpur city of Madhya Pradesh. This pond is located at a distance of about 2 km from Gohalpur thana beside Jabalpur Puraina road. Catchment area of pond is 24 hectares and depth is more than 10 meters. At present, the pond has become shallow and infested with variety of macrophytes. Villagers largely depend upon this pond for their daily needs. The pond receives domestic drainage from all sides. Vested interests for their own benefits have damaged the bank till recently binding (1) pond water which has resulted in fast shallowing of the pond in that area adversely affecting the biomass, thereby providing detrimental to the purpose of fish farming, initially aimed at.

Five stations were selected at the pond to study physico-chemical and planktonic attributes. Limnological studies on Amkhera pond were carried out monthly from March 2000 to Feb 2002 between 8.00 a.m. to 10.00 a.m. Water samples were collected by using one litre capacity of modified Hale's sampler and collected samples were transferred into one litre plastic bottles for the analysis of physico-chemical parameters according to the methods given by APHA (1985). Biological samples were collected by filtering 25 litres of water through planktonic net (No. 25 mesh diameter of the pore is 60 m) and were preserved in 5% formaldehyde solution and concentrated up to 5 ml (APHA 1985; Trivedy and Goel, 1986). For the identification and counting, 0.05 ml of sample was taken. The count was done by Lackey's Drop method (Lackey, 1938). After the microscopic examination, they were identified with the help of standard literature (Adoni 1985).

RESULT AND DISCUSSION

A total of 10 species of Odonates belonging to five sub-families, Libellulinae, Sympetrinae, Coenagrionidae, Trithemistinae, Trameinae of family Libellulidae.

Calculation of Zooplankton

No. of zooplankton = Ax 1/L x n/V

where, A = number of organisms per drop

V = volume of one drop = 0.05 ml

n = Total valume of concentrated sample = 5 ml

L = Volume of original sample = 25 lit.

Calculation of Shannon's Species Diversity Index = H (Shannon and Wiever, 1949)

H = S (ni/N) log (ni/N) or - S Pi log Pi.

where, H = Shannon index of general diversity

ni = No. of individuals of each species

N = Total no. of individuals in the sample (N= ni)

Pi = Importance probability for each species (ni/N)

RESULTS

Results of physico-chemical analysis may be summarized as under: Atmospheric temperature fluctuated between 44.2^0 C and 8.7^0 C, whereas water temperature varied from 17^0C to 30^0 C. Humidity fluctuated between 18% to 98%, and monthly rainfall was maximum as 549.0 mm and minimum as 0.0 mm to 0.13 mm Maximum depth was recorded as 16 feet whereas minimum as 3 feet. Secchi disc transparency varied from 26 cm to 75 cm. Table 1 indicates the scale rating for water quality as per standards (Tiwari and Mishra, 1985; Singh, 1992).

Table 2 gives comparative results of annual average range of physico-chemical parameters at five stations of Amkhera pond with their quality ratings. Table clearly indicates that the quality rating for total aikalinity was found zero throughout the course of study Similarly, quality ratings for BOD (50) and COD (80) always remained at moderate pollution level. During the first year of study, average range for total solids scored quality rating of 80 'slight' but unfortunately due to increasing pollution it reaches up to moderate (50) pollution level. Phosphate, chloride and pH remained within the permissible limit with quality rating of 100.

Due to low quality ratings of total solids, total alkalinity, BOD, COD and nitrates, water quality is not said to be suitable for drinking. Water Quality Index (WQI) based on discussed chemical parameters is calculated as 78.80 for the first year and as 74.00 for the second year (Kesharwani *et. al.*, 2004). It clearly indicates and establishes that pollution gradually increased in Amkhera pond during the course of study. Similar studies were also carried by Tiwari and Mishra (1985), Kumar et al. (2002) and Tyagi *et. al.*, (2003). It is worthwhile to mention that pond is quite rich in nutrients as it comprises mainly of wastewaters from animal sheds having a lot of excreta, besides surface runoff and waste water from bathrooms.

RESULTS OF SPECIES DIVERSITY

As stated earlier, ratios between the number of species and "importance values" (number, biomass, productivity and so on) of individuals are called 'species diversity'. It tends to be low in physically controlled ecosystems (i.e. subjected to strong physico-chemical limiting factors) and high in biologically controlled ecosystem (Odum, 1971).

The widely used Shannon function or H index, which is a mimic of the so-callled information theory formula that contains hard to calculate factorials, combines the variety and evenness components as one overall index of diversity. This index is one of the best index because it is reason-

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ably independent of sample size (which means that in practice fewer samples are required to obtain a reliable index for the purpose of comparison). It is also normally distributed, so that routine statistical methods can be used to test for significance of differences between means. It can be noted that both e and H behave inversely to the index of dominance (c) (Odum, 1971; Kesharwani *et. al.*, 2005). Table No. 3 shows that the calculated value of general diversity H (Shannon's Index) for the year 2001-02 was 1.1441. Wilhm and Dorris (1968) also consider that the clean waters will have a diversity value above 3 which declines at higher pollution. Similar observations were reported by Jain, (1996) Groupwise comparison shows that lowest diversity was exhibited by the Crustaceans as 0.1136 and highest by the Crustaceans as 0.6307 while Rotifers showed H = 0.4238. Low values of H during the study period reflect low diversity as compared to clean water which is also supported by physico-chemical analysis and Water Quality Index.

Table No. 1: SCALE RATING FOR WATER QUALITY AS PER STANDARDS (Tiwari & Mishra, 1985; Singh, 1992)

S. No.	Parameters	Degree of Pollution			
		Permissible	Slight	Moderate	Severe
		Quality Rating			
		100	80	50	0
1.	Ph	7.00-8.5	8.6-8.8 6.8-7.0	8.9-9.2 6.5-6.7	> 9.2 < 6.5
2	Total Alkalinity (mg/l)	< 50	51-85	86-120	> 120
3.	Chloride content (mg/l)	< 200	201-350	351-500	> 500
4.	Nitrate (mg/l)	< 4	4.1-6.0	6.0-10.0	> 10
5.	Phosphate (mg/l)	> 2	2.4-3.0	3.1-5.0	> 5.0
6.	Dissolved Oxygen (mg/l)	>6	5.0-6.0	4.1-5.0	< 4 0
7.	Total Solids (mg/l)	< 500	501-1000	1001-1500	> 1500
8.	B.O.D. (mg/)	< 10	11-20	21-30	> 30
9.	C.O.D. (mg/l)	< 50	51-150	151-250	> 250

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Table No. 2: Comparison of annual average range of physico-chemical parameters of five stationsof Amkhera Pond, Jabalpur, their quality rating (in bracket).

Parameters	2000-2001										2001-2002									
	S1		S2		S3		S4		S5		S1		S2		S3		S4		S5	
	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B
pH	7.75 (100)	7.53 (100)	7.64 (100)	7.45 (100)	7.65 (100)	7.59 (100)	7.50 (100)	7.38 (100)	7.45 (100)	7.40 (100)	7.55 (100)	7.44 (100)	7.62 (100)	7.47 (100)	7.75 (100)	7.57 (100)	7.71 (100)	7.56 (100)	7.48 (100)	7.36 (100)
Total alkalinity (mg/l)	173.75 (0)	176.66 (0)	167.08 (0)	176.25 (0)	205.00 (0)	209.16 (0)	164.16 (0)	174.16 (0)	152.91 (0)	160.83 (0)	187.91 (0)	196.25 (0)	173.75 (0)	182.91 (0)	177.50 (0)	188.33 (0)	147.91 (0)	156.66 (0)	152.0 8 (0)	161.66 (0)
Chloride (mg/l)	75.87 (100)	76.58 (100)	69.58 (100)	69.08 (100)	78.75 (100)	75.25 (100)	67.66 (100)	67.16 (100)	66.25 (100)	70.06 (100)	73.91 (100)	72.91 (100)	69.50 (100)	68.58 (100)	78.08 (100)	75.50 (100)	67.75 (100)	67.16 (100)	66.50 (100)	66.33 (100)
Nitrate (mg/l)	6.85 (50)	5.47 (80)	4.22 (80)	3.37 (100)	5.74 (80)	4.00 (80)	5.13 (80)	3.70 (100)	3.94 (100)	2.82 (100)	7.31 (50)	6.12 (50)	4.60 (80)	3.75 (100)	6.23 (50)	4.35 (80)	5.66 (80)	4.15 (80)	2.40 (100)	1.77 (100)
Phosphate (mg/l)	1.45 (100)	1.54 (100)	0.44 (100)	0.32 (100)	0.64 (100)	0.47 (100)	0.51 (100)	0.52 (100)	0.25 (100)	0.29 (100)	1.52 (100)	1.57 (100)	0.45 (100)	0.36 (100)	0.72 (100)	0.53 (100)	0.44 (100)	0.50 (100)	0.31 (100)	0.37 (100)
Dissolved Oxygen (mg/l)	6.13 (100)	5.87 (80)	7.28 (100)	6.75 (100)	6.23 (100)	6.42 (100)	6.52 (100)	6.60 (100)	7.12 (100)	7.13 (100)	6.48 (100)	6.03 (100)	7.16 (100)	6.47 (100)	7.07 (100)	6.57 (100)	6.35 (100)	6.08 (100)	7.31 (100)	7.15 (100)
Total Solids (mg/l)	761.50 (80)	750.33 (80)	680.00 (80)	705.50 (80)	724.00 (80)	718.00 (80)	636.41 (80)	646.16 (80)	638.50 (80)	643.50 (80)	1341.50 (50)	1431.75 (50)	1128.66 (50)	1075.33 (50)	1142.50 (50)	1131.33 (50)	996.00 (80)	975.66 (80)	920.5 0 (80)	920.66 (80)
B.O.D. (mg/l)	21.76 (50)	21.72 (50)	20.76 (50)	20.80 (50)	22.91 (50)	23.12 (50)	21.95 (50)	22.09 (50)	19.75 (50)	19.89 (50)	23.70 (50)	23.75 (50)	23.00 (50)	23.13 (50)	24.57 (50)	24.62 (50)	23.82 (50)	23.87 (50)	21.03 (50)	21.00 (50)
C.O.D. (mg/l)	88.30 (80)	77.75 (80)	74.00 (80)	69.50 (80)	89.66 (80)	87.30 (80)	79.75 (80)	77.83 (80)	69.66 (80)	67.16 (80)	102.50 (80)	102.31 (80)	79.08 (80)	82.16 (80)	100.16 (80)	102.00 (80)	81.83 (80)	90.00 (80)	62.07 (80)	75.33 (80)

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Table No. 3: Calculation of Shannon's index of general diversity (H) for the year 2000-2001 and 2001-2002

Name of Zooplankton	2000-2001 Total No. of species	2000-2001 Total No. of Zooplankton	2000-2001 Pi = (ni/N)	2000-2001 Log10 Pi	2000-2001 Pi x Log10 Pi	2001-2002 Total No. of species	2001-2002 Total No. of Zooplankton	2001-2002 Pi = (ni/N)	2001-2002 Log10 Pi	2001-2002 Pi x Log10 Pi
Protozoa										
Paramoecium	S=1	9325	0.126569393	-0.897671304	-0.113617712	S = 1	10600	0.121832079	-0.914238346	-0.111383558
Total		9325			-0.113617712		10600			-0.111383558
Rotifera										
Brachionus		9250	0.125551408	-0.901178412	-0.113144219		16250	0.186770875	-0.728690846	-0.136096227
Filinia		625	0.008483203	-2.071440127	-0.017572448		875	0.010056893	-1.997536158	-0.020089008
Hexarthra		200	0.002714625	-2.566290149	-0.006966516		550	0.006321476	-2.199181522	-0.013902073
Keratella		9675	0.131319986	-0.881669171	-0.115780784		3975	0.045687029	-1.340207078	-0.061230080
Monostyla	S = 10	350	0.004750594	-2.323252100	-0.011036827	S = 9	925	0.010631573	-1.973402479	-0.020980372
Mytilina		300	0.004071936	-2.390198890	-0.009732741		600	0.006896155	-2.161392961	-0.014905302
Polyarthra		1725	0.023413641	-1.630531045	-0.038176669		600	0.006896155	-2.161392961	-0.014905302
Streblocerus		575	0.007804547	-2.107652300	-0.016449271		0	0.000000000	0.000000000	0.000000000
Trichocera		2925	0.039701391	-1.401194274	-0.055629362		1000	0.011493592	-1.939544211	-0.022292330
Testudinella		1800	0.024431625	-1.612047639	-0.039384944		1100	0.012642952	-1.898151526	-0.023998238
Total		27425			-0.423873779		25875			-0.328400932
Crustacea										
Bosmina		1600	0.021717000	-1.663200162	-0.036119718		1350	0.015516350	-1.809210443	-0.028072342
Cypris		3175	0.043094673	-1.365576415	-0.058849068		3700	0.042526292	-1.371342487	-0.058318110
Cyclops		5475	0.074312861	-1.128936021	-0.083894465		1825	0.020975806	-1.678281343	-0.035203304
Ceriodaphnia		275	0.003732609	-2.427987451	-0.009062729		5825	0.066950175	-1.174248282	-0.078616128
Daphnia		2425	0.032914829	-1.482908402	-0.048799801		3925	0.045112350	-1.345704550	-0.060707894
Diaptomus		3600	0.048863251	-1.311017644	-0.064060684		6530	0.075053158	-1.124631030	-0.084407110
Diaphanosoma	S = 13	1000	0.013573125	-1.867320145	-0.025345370	S = 13	2800	0.032182059	-1.492386180	-0.048028059
Eubranchiopus		2575	0.034950797	-1.456542911	-0.050907336		4925	0.056605942	-1.247137977	-0.070595420
Moina daphnia		5650	0.076688157	-1.115271697	-0.085528131		12800	0.147117982	-0.832334242	-0.122451334
Microthenix		3300	0.044791313	-1.348806205	-0.060414801		975	0.011206253	-1.950539596	-0.021858239
Nauplius		7725	0.104852392	-0.979421656	-0.102694704		4850	0.055743923	-1.253802473	-0.069891868
Simocephalus		100	0.001357313	-2.867320145	-0.003891850		550	0.006321476	-2.199181522	-0.013902073
Sida		25	0.000339328	-3.469380136	-0.001177258		475	0.005459456	-2.262850602	-0.012353934
Total	S = 24	36925			-0.630745817		50630			-0.704406817
Grand Total N		73675			-1.168237308		87005			-1.144190307

Shannon's Index H =Σ Pi x Log10 Pi 1.68237308
Evenness Index e = 0.990101690

Shannon's Index H = Σ Pi x Log 10 Pi =1.144190307
Evenness Index e = 0.97650165

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E-WASTE AS AN EMERGING PROBLEM

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Abstract

Ãn increasing electronic waste generation in different activities is causing a great impact in varying ways in respect of Pollution impacts, Socio-economic impact, ecological disturbances, land locking problems etc. It is becoming a growing problem day by day at countries, continental and global level. Different National and International organizations as well as Nongovernmental Organizations are engaged to identify and predict the impacts of such waste in their countries for global awareness. E –waste is contributing its 1-3% role in total municipal solid waste.

Key Words: E-Waste, Pollution Impacts, Land Locking Problems, Electrical And Electronic Waste.

Pages:7 References: 14

INTRODUCTION

Electrical and electronic waste, a part of the municipal solid waste is growing since last two decades neither being proper concerning its disposal in both developed and developing countries nor any environmental organizations posing the challenges to municipal solid waste community for management. The burgeoning development of electronic and electrical manufacturer has been creating a problem more than threshold considerable level by promoting their waste production through various sources. Furthermore, this waste has also been known as E-Waste or WEEE (Waste Electrical Electronic Equipments) and European Union (EU) coined this term. According to the EU definition, EEE are those devices which generates, transfer, measurements the such currents that designed to forbear the voltage of 1000 volts for alternative currents and 1500 volts for Direct current and their categories are set out in Annex IA to Directive 2002/96/EC (WEEE) (Directive 2002; WEEE, 2003). It is collectively discarded equipments of electronic and electrical devices and comprises of both hazardous and non-hazardous

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category of such electronic and electrical appliances that has reached its EOL (End of Life) such as televisions, personal computers, telephones, air conditioners, cell phones, electronic toys, lifts, refregirators, washing machines, dryers, and kitchen utilities, or even airplanes, etc. WEEE is facing major challenges for its management by operators, engineers, regulators. In addition, retailers consumers who deals this waste as a normal solid waste. Another reason of growth of the e-waste is due to innovation of new technologies in design, size, and volume has been followed by regime of electrical and electronic industries. New technology promotes a rapid pace to this E-waste to reach its EOL (End of Life i.e. broken, outdated, unwanted). E-waste contributes its presence overall in developed countries about 1% of total solid waste generated at global level on an average, for example, USA accounts 1-3% for generation of e-waste of total generated municipal solid waste (Townsend, 2011). On the other way, in developing countries an increasing "market penetration" as well as "replacement market" in developed countries and "high obsolescence rate" make E-waste one of the fastest waste streams (UNEP, 2007). Since it contains precious metals in and has costly methods and procedures to dispose and dismentalization, developed countries prefer its illegal transportation to developing countries to overcome the problem of bearing costly procedure of dismentalization. As this waste has more tradable commodity value than other MSW so, mostly western countries transport their 80% e-waste to developing countries that is India, China, and Japan through coastal areas.

The major problem which arises due to this waste is particularly on human being and other living organisms, which exist at top level in the ecosystem. This waste generates a toxicity of heavy metals which releases harmful compounds into the dumping area in the form of latchets. In other way, they are concerning problem due to their size, volume and their storage. Waste Electrical and Electronic Equipment (WEEE) or E-waste is one of the fastest growing waste streams in the world. There is a pressing need to address e waste management particularly in developing countries. The presence of valuable recyclable components attracts informal and unorganized sector. The unsafe and environmentally risky practices adopted by them pose great risks to health and environment (UNEP, 2007).

Why they are different from other municipal waste?

E-Waste contains in itself different types of components in which some are useful as well as belong to Hazardous category. Since it is a part of general municipal solid waste but it has different criteria for its treatment. It contains valuable precious metals like Copper (Cu), Aluminum (Al), Gold (Au) and Silver (Ag) are found in their waste over 60% (Widmer *et. al.*, 2005). Although, the guidelines for sound management of E-Waste derived by MoEF (Ministry of Environment and Forestry) reports that more than 1000 different potentially toxic and hazardous substances, such as PVC, PCB, POP (Persistent Organic Pollut-

ants i.e., PAN, Dioxins), which is harmful for human and environment is contained in E-waste if these are not properly managed (MoEF, 2008). During the segregation of this waste, it is categorized on the basis of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards (PCBs), concrete and ceramics, rubber and other items. The different composition of WEEE is found in diverse way in different products. They are categorized mainly Hazardous and Non Hazardous category, Ferrous and Non Ferrous metals, Plywood, Glass, Printed circuit Board, Concrete, Ceramics and more than 1000 substances fall in this categories (UNEP, 2007).

Toxic metals Included

There are different Toxic metals listed below which is going on all discarded/disposed materials as well as all wastes that poses Hazardous characteristics covered by Basel Convention covers all discarded/disposed materials that possess hazardous characteristics defined in Annex VIII, refers to E-waste, which is considered hazardous under Art. 1, para. 1(a) of the Convention (Directive 2002/96/EC), Table 3. Metal wastes and waste consisting of alloys of any of the following: Antimony, Arsenic, Beryllium, Cadmium, Lead, Mercury, Selenium, Tellurium, Thallium.

Concerning problem at Global Level

E-waste now has been seen as emerging problem globally due to their unregulated production by developed countries who bypass the necessity of management rule to treat this waste and to overcome the problem they usually transport their waste to developing countries where these waste are not being taken strictly in consideration. According to Basel Action Network executive director Jim Puckett recycling companies might not be as honest about what they are doing with your old electronics in US, about 80 percent of that material, very quickly, finds itself on a container ship going to a country like China, Nigeria, India, Vietnam, and Pakistan where very dirty things happen to it, mentioned by Castillo (2011). Furthermore, the advent of new technologies in Information and Technology sector are making these electronic and electrical equipments towards the obsolete nature. Moreover, an increase in “market penetration” in developing countries, “replacing market” in developed countries and obsolete nature of this waste makes them considering stream of waste (UNEP, 2007). All OECD (Organization for Economic Cooperation and Development) countries, which have limited market for Electrical and Electronic Equipments, have been facing a problem to managing this growth of E-Waste (Castillo, 2011). An e-waste recycler company (OTCQB: EWSI) (the “Company”), an electronic waste management services, technology and reverse logistics company and the first public pure E-Waste company estimated and reported that about 1,600,000 tons worth of e-waste is being generated in India at domestic level (Borthakur and Sinha, 2013). According to the MAIT report, India had been estimated or generating about 0.8 million tonne E-Waste by 2012 annually. Rapid economic growth, coupled with urbanization and a growing demand for consumer goods, has increased both the consumption and the production of EEE (Babu *et. al.*, 2007). It has also been mentioned that a rapid changes of production by adapting and introduction of new technologies that speeded up the processing of EEE promoting generation of obsolesce the previous and old EEE. For example, new

generation of laptops and mobile phones are using advance version with its new product that makes a competition among the production companies to innovate new more technologies that must be advanced, compatible as well as profitable to manufacturer. Even volume, size and space occupied by EEE also replacing their old versions such as taking preference of laptops instead of Desktops due to availing of its portability (Borthakur and Sinha 2013). On the way of social scenario, the impacts of E-waste on Social livelihood have been assessed by many governmental, Non-governmental, National as well as International organizations at large extent. According the report of International Labour Organization (Lundgren, 2012), who studied the global impact if e-waste and addressing the various challenges derived by them, a study has been conducted on E-waste on recycling operation that have identified in different location of India and China to assess the social and physical impact of this waste in concerning of livelihood of wage dependent workers. The major issues has been concerned by ILO is given below

- **High volumes** – High volumes are generated due to the rapid obsolescence of gadgets combined with the high demand for new technology.
- **Toxic design** – E-waste is classified as hazardous waste (Tsydenova and Bengtsson, 2011) having adverse health and environmental implications. Approximately 40 per cent of the heavy metals found in landfills comes from electronic waste.
- **Poor design and complexity** – E-waste imposes many challenges on the recycling industry as it contains many different materials that are mixed, bolted, screwed, snapped, glued or soldered together. Toxic materials are attached to non-toxic materials, which makes separation of materials for reclamation difficult. Hence, responsible recycling requires intensive labor and/ or sophisticated and costly technologies that safely separate materials .
- **Labour issues** – These include occupational exposures, informal sector domination causing health and environmental problems, lack of labor standards and rights.
- **Financial incentives** – In general, there is not enough value in most e-waste to cover the costs of managing it in a responsible way. However, in line with EPR policies, new opportunities can be realized with the rise in the price of many of the materials in electronics, such as gold and copper (Widmer et. al., 2005). Furthermore, with rising e-waste quantities, formal recyclers are increasingly entering the e-waste recycling sector .
- **Lack of regulation** – Many nations either lack adequate regulations applying to this relatively new waste stream, or lack effective enforcement of new e-waste regulations .

E-waste problem magnitude in developing and developed country

As already mentioned in introduction, the scenario of E-waste between developed and countries addressing its transboundary movement. About 80% e-wastes are transported from developed countries to developing countries to escape from bearing cost for its proper regulation and management in developed countries and cheap labor lump sum and leniency in sound environmentally E- waste management in developing countries. Since its illegal trade and transboundary movements from one place to another place, also carries toxic compounds associated with them that produce harmful impacts

on environment and livelihood, so ILO has described it as Green Criminology reported. Because of high penetration of "grey market" in Asia, this waste moves through a series of buyers, sellers and brokers where it is evaluated general solid waste after removing (dismantling and segregation) of useful parts.

For the USA, Europe and Japan, Hong Kong has recognized as their e-waste dumping centre and soil tests shows excessive levels of lead by discarded computers. Taiwan also lack in adequate waste management facilities. In India, Delhi has recognized as hub of collection for obsolete computers as E-waste for northern region of India and beside this in southern region Mumbai, Pune, Bangalore, been also recognized. A contribution for generating discarded electronic materials by Asian countries about an estimation of 12 million tons each year. Thailand has been known for generating a very large amount of obsolete equipments related to mobile phone and batteries and also has recognized as largest dumping site for the Asia (Mohan and Bhamawat, 2008).

Table 1. Guidelines of categories set out in Annex IA to Directive 2002/96/EC (WEEE) and designed for use with a voltage rating not exceeding 1000 volts for alternating current and 1500 volts for direct current.

Categories of electrical and electronic equipment covered by this Directive:
• Large household appliances • Small household appliances • IT and telecommunications equipment • Consumer equipment • Lighting equipment • Electrical and electronic tools (with the exception of large-scale stationary industrial tools) • Toys, leisure and sports equipment • Medical devices (with the exception of all implanted and infected products) • Monitoring and control instruments • Automatic dispensers

Table 2. Comparison between Municipal Solid Waste and E-waste

Properties	Municipal Solid Waste	E-Waste
Definition and Composition	Household wastes-Papers, woods and Cardboards, Polythenes, Medical Wastes, vegetables, Industrial waste, constructions & Demolition waste	All Electrical and Electronic wastes bearing voltages of 1000 volts for AC and 1500 Volts for DC.(EU 2002) All electronic & electrical equipments that has become obsolete and reached its EOL (End of Life i.e. Discarded, Outdated and Broken) (**UNEP report vol-1.2007**)
Toxic Chemical compounds found in Waste	NH_3, CO_2, CH_4, NO_3-, PO_4-, PAN, PAHs	POPs, Polymers relating to Plastics and BFR, Toxic metals including Heavy metals , PCB, PBDE, PAN, CFCs, HCFCs, PBDD.
Hazardous chemical compounds and precious metals and elements	Hg, Cu, Fe, Pb, Cd and mainly CH_4, NH_3 production underneath the stalk.	Pb, Hg, Cu, Fe, Se, Si, Al and instead of this precious elements are also found i.e. Au, Ag, Pt, Al, Cu, Pd (Townsend, 2011)
Treatment	Incerination, Recycling, Segregation, Land filling	Dismantling, Segregation, Recycling, Land filling
Land filling	Yes	Yes

Table 3: Components of and composition of E-waste

Components	% Composition
Iron and steel	50
Plastics	21
Non ferrous metals	13

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EFFECT OF NOISE ON STUDENT'S PERFORMANCE AT ELEMENTARY LEVEL IN HAZARIBAG

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Abstract

The learning environment provided by a school should be understood as resulting from a complex, dynamic relationship between the various physical elements and the attitudes and actions of the different users who constitute the school community. Therefore, although the identification of problems with the physical setting may be aided by a narrow focus, any attempts to improve the environment and facilitate better learning will require a wider perspective.

Noise can interfere with learning in the following areas: reading, motivation, language and speech acquisition, mathematical calculation and memory. The strongest findings to date are in the area of reading (FICAN, 2000). There has been a considerable amount of research in the past 40 years into the effects of noise on the performance of school children (Hetu *et, al.* 1990; Evans & Lepore 1993; Shield & Dockrell 2003). It is generally accepted that noise has a detrimental effect upon the learning and performance of primary school children, and that the older children in this age group are more affected than the younger children (Berglund & Lindvall 1995; Institute for Environment and Health 1997). Activities affected by noise include memory, reading, motivation, and attention (Bronzaft 1981; Cohen *et, al.* 1981; Hygge *et, al.* 1996; Berg *et, al.* 1996; Maxwell & Evans 2000; Lundquist et al. 2000; Haines *et, al.* 2002; Clark *et, al.* 2006). There is increasing evidence that poor classroom acoustics can have a particularly negative effect upon children with special needs such as hearing impairment (Nelson & Soli 2000) or learning difficulties (Bradlow *et, al.* 2003)

Key Words : Academic Performance, Impact of Noise, Noisy Environment, Classroom Noise on Student Performance.

Pages:09 References:14

INTRODUCTION

This paper presents the results of a project carried out to assess the noise exposure of children at elementary schools in Hazaribag and to examine the impact of both environmental and classroom noise upon their academic performance. The

impact of noise upon performance was examined in two ways: by investigating relationships between internal and external noise levels and children's performance in nationally standardized tests of numeracy and literacy; and by experimental testing of children in different classroom noise conditions. It will be shown that the results of the two investigations of the impact of noise were consistent, showing that both environmental and classroom noise have detrimental effects upon children's academic performance, causes destructed concentration and also that noise has more of an impact upon children with special educational needs than upon other children.

MATERIAL AND METHODS

Present research was conducted using survey and case study method. Two sets of questionnaire were developed according to NCF – 2005 for testing English, Hindi and mathematics. 4000 students of 10 schools of class 1 to 8 were examined for the purpose. The survey was conducted in Hazaribag district of Jharkhand, India. Questions were written on the board and plain papers provided to students for answering the same. Schools of silent zone were selected as students of these schools are not used to noisy environment. First set of questionnaire was used to test student's performance in natural (control) conditions. Students were requested to come next day to school necessarily. Next day when exam started an external source of sound was placed in front of school. Answer sheets of both the day were evaluated and marks compared. Results were prepared in the form of grades.

OBSERVATION

An observation was made to assess the noise level in various regions of schools.

Noise Level in different places of schools

School	Number of Students	Occupied classrooms (in dB)	Empty classrooms (in dB)	Corridor (in dB)	Occupied halls (in dB)	Empty halls (in dB)	Playground (in dB)
A	377	72.1	47	58.1	73.4	53.2	72.9
B	389	73.9	46.8	59.4	74.2	53.1	74
C	392	74	47.1	59.6	74.4	53.6	73.9
D	312	72	46.4	59.2	73.2	53	72.6
E	462	74.2	47	60	74.7	53.2	74.5
F	433	74	46.7	59.5	74.3	53.3	74.7
G	366	72	47	58	73.1	53	72.9
H	475	74.5	47.3	60	74.9	53.3	74.5
I	408	74	47.1	59.6	74.4	53.6	73.9
J	386	73.9	46.8	59.4	74.2	53.1	74
Average	400	73.46	46.92	59.28	74.08	53.24	73.79

First set of questionnaire was used to test student's performance in natural (control) conditions.

Effect of Noise on Performance Level of Students (Control)

English

School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	41	55	101	108	72
B	389	40	65	105	112	67
C	392	41	53	99	120	79
D	312	31	38	82	98	63
E	462	46	62	126	142	86
F	433	49	61	112	133	78
G	366	37	51	94	112	72
H	475	55	59	130	141	90
I	408	43	52	115	121	77
J	386	43	53	99	122	69
Average	400	42.6	54.9	106.3	120.9	75.3
Percentage		10.65	13.73	26.58	30.23	18.83

Effect of Noise on Performance Level of Students (Control)

Hindi

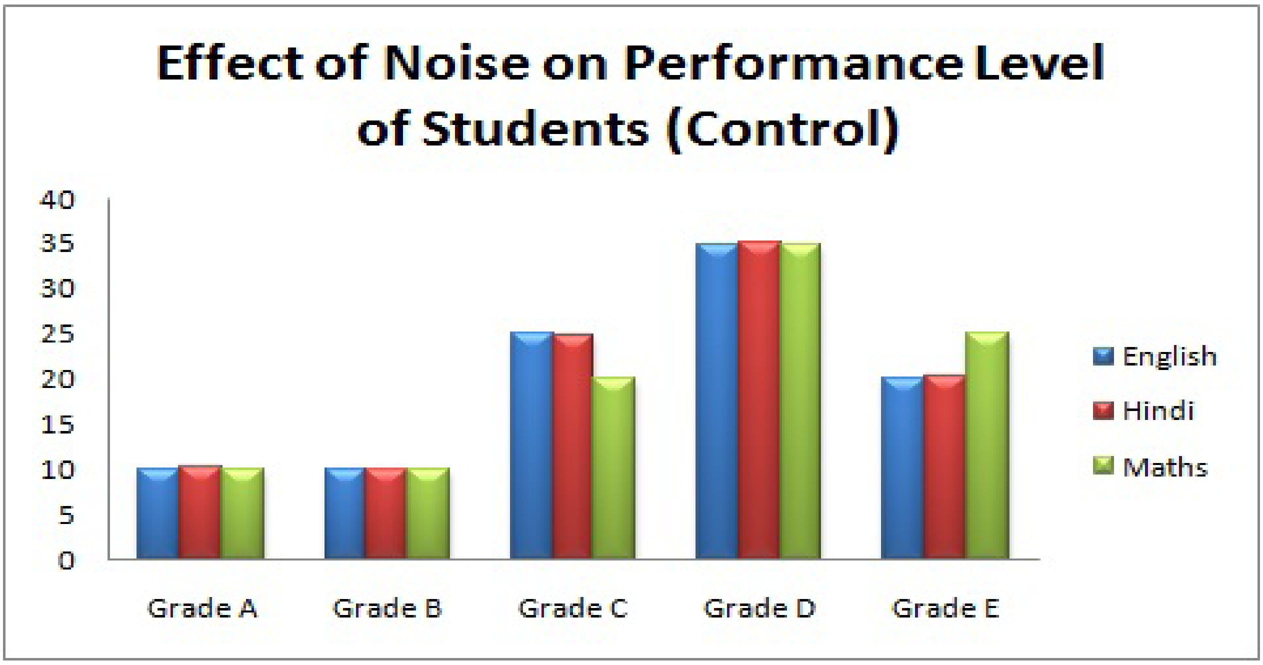
School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	42	81	122	94	38
B	389	44	83	129	91	42
C	392	46	86	114	100	46
D	312	31	65	105	78	33
E	462	46	100	162	109	51
F	433	42	86	148	110	47
G	366	38	72	120	95	41
H	475	47	96	159	116	57
I	408	41	82	138	102	45
J	386	39	80	127	94	46
Average	400	41.6	83.1	132.4	98.9	44.6
Percentage		10.40	20.78	33.10	24.73	11.15

Effect of Noise on Performance Level of Students (Control)

Mathematics

School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	94	37	128	76	42
B	389	97	40	133	76	43
C	392	98	41	130	79	34
D	312	78	29	110	64	31
E	462	115	50	162	93	42
F	433	109	43	148	86	47
G	366	92	41	122	72	39
H	475	118	50	162	96	49
I	408	102	41	143	82	40
J	386	96	43	134	78	35
Average	400	99.9	41.5	137.2	80.2	40.2
Percentage		24.98	10.38	34.30	20.05	10.05

It was observed that students are generally weak in mathematics. Language performance was more or less same. Out of 4000 students on an average 10% students are placed in grade A in language and 25% in mathematics. In grade B 10.38% students are in mathematics, 20.78% in Hindi and 13.73% in English. In grade C, in mathematics 34.3%, 33.10% in Hindi and 26.58%students are placed in English. In grade D 20% students are placed in mathematics,24.73% in Hindi and 30.23 in English and 10% in grade E, in mathematics, 11% in Hindi and 18.83 in control conditions.



Students were requested to come next day to school necessarily. Next day when exam started an external source of sound was placed in front of school. Answer sheets of both the day were evaluated and marks compared. Results were prepared in the form of grades.

Effect of Noise on Performance Level of Students (Test)

English

School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	38	37	94	132	76
B	389	40	40	97	136	76
C	392	39	41	98	135	79
D	312	31	29	78	110	64
E	462	46	46	115	162	93
F	433	43	43	109	152	86
G	366	37	37	92	128	72
H	475	47	47	119	166	96
I	408	40	41	102	143	82
J	386	39	39	96	134	78
Average	400	40	40	100	139.8	80.2
Percentage		10.00	10.00	25.00	34.95	20.05

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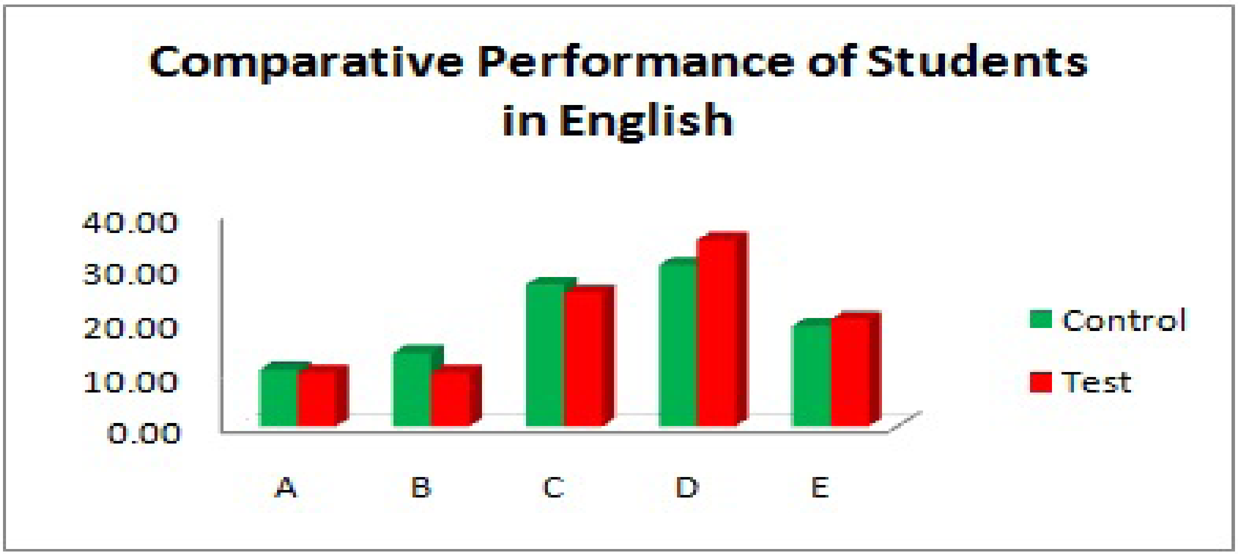
Effect of Noise on Performance Level of Students (Test)
Hindi

School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	37	38	94	132	76
B	389	40	40	97	136	76
C	392	41	39	98	135	79
D	312	29	31	78	110	64
E	462	46	48	109	163	96
F	433	42	43	110	152	86
G	366	34	37	95	128	72
H	475	47	50	116	166	96
I	408	41	40	102	143	82
J	386	39	39	94	134	80
Average	400	40.5	39.6	99.3	139.9	80.7
Percentage		10.13	9.90	24.83	34.98	20.18

Effect of Noise on Performance Level of Students (Test)
Mathematics

School	Number of Students	Grade A	Grade B	Grade C	Grade D	Grade E
A	377	38	37	76	132	94
B	389	40	40	76	136	97
C	392	39	41	79	135	98
D	312	31	29	64	110	78
E	462	46	46	93	162	115
F	433	43	43	86	152	109
G	366	37	37	72	128	92
H	475	47	47	96	166	119
I	408	40	41	82	143	102
J	386	39	39	78	134	96
Average	400	40	40	80.2	139.8	100
Percentage		10.00	10.00	20.05	34.95	25.00

Out of 4000 students on an average 10% students are placed in grade A and B, 20% in grade C, in mathematics and 25% in language, 35% in grade D and 25% in grade E, in mathematics and 20% in language in test conditions.


Comparative Performance of Students in English
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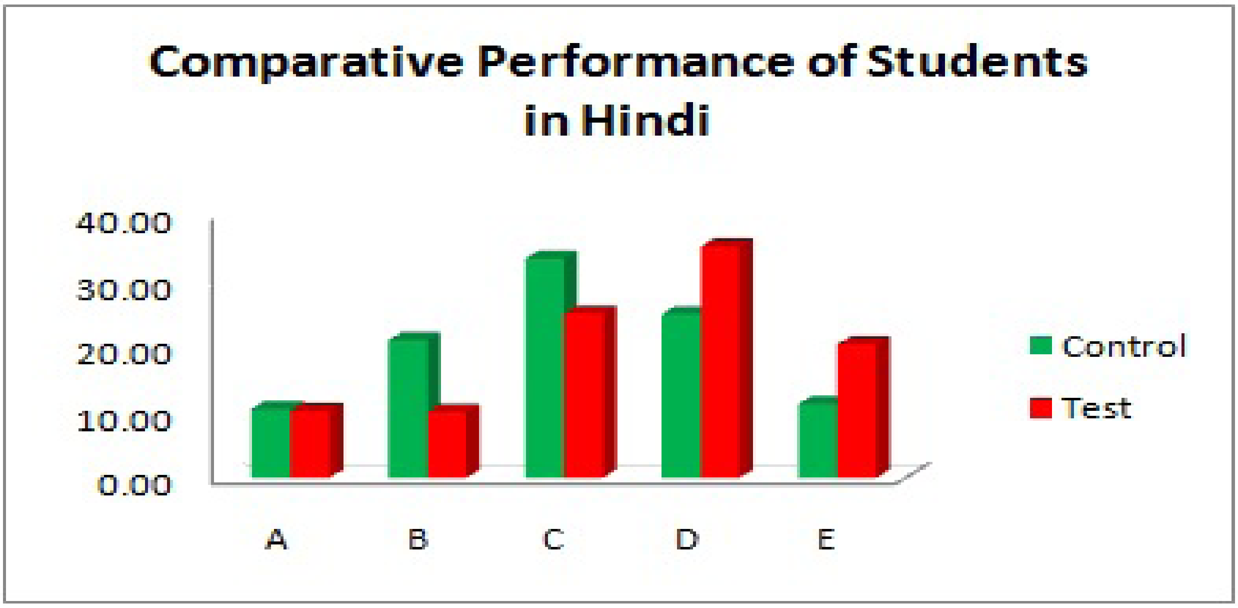
Test


Comparative Performance of Students in Hindi
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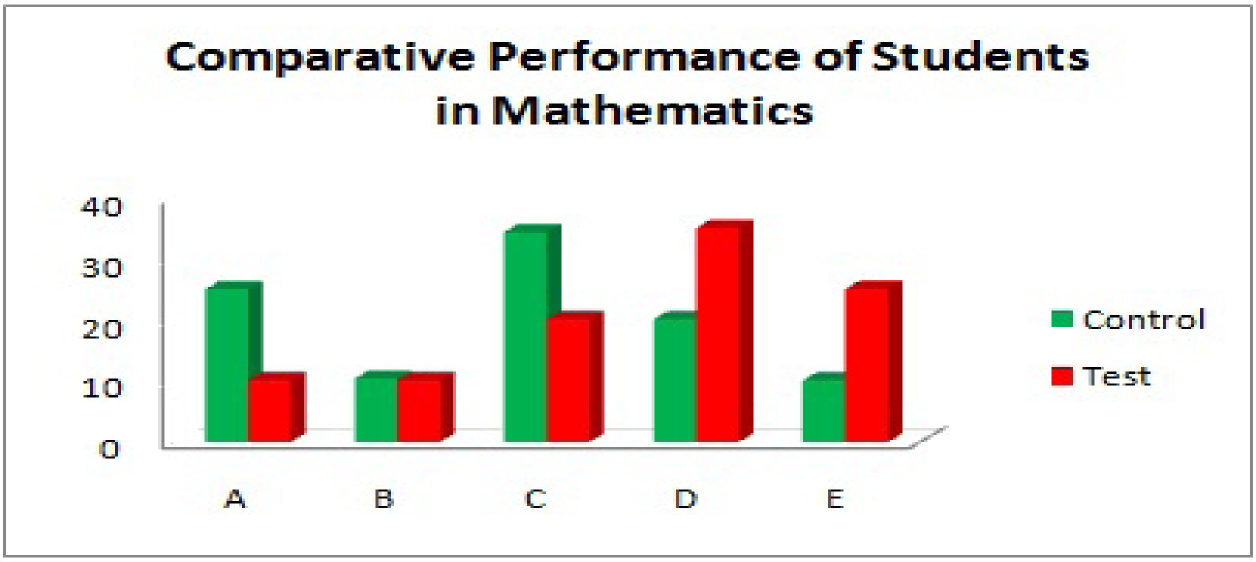
Comparative Performance of Students in Mathematics
40
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E
Control
Test

DISCUSSION

The results support the contention that the effect of noise on student performance varies according to the task involved. It is also revealed that performance in mathematics decreased when exposed to sound. It may be due to disturbed concentration resulting from noise.

Noise interferes with learning, through direct effects on information processing, and via indirect effects on teachers, learners and communication in the classroom. The variety of these routes suggest why noise is a serious problem for schools but also why the causal mechanisms proposed, principally interference with speech intelligibility, distraction and annoyance are each unlikely to provide complete explanations of how noise interferes with learning. Our results are in accordance with the findings of Woolner and Hall (2010). Since the central mechanical systems were activated and comprising the majority of the background noise content during the measurements, this indicates that mechanical systems should be designed with lower background noise levels in elementary school classrooms to optimize student learning and achievement. These findings are also in accordance with Ronsse and Wang (2010).

Finally, we suggest that solutions to noise problems will not be produced by viewing noise in isolation, or even as part of the physical environment, but through participatory approaches to understanding and adapting the structure, organisation and use of learning spaces in schools.

Further research is needed to clarify the effect of intelligence and classroom noise on student performance.

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HEALTH HAZARDS BY E-WASTE AT GLOBAL LEVEL

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Abstract

É-waste has its presence overall in developed countries about 1% of total solid waste generated at global level on an average, for example, USA accounts 1-3% for generation of E-waste of total generated municipal solid waste (Timothy .G Townsend., 2011). Moreover, in developing countries an increasing "market penetration" as well as "replacement market" in developed countries and "high obsolescence rate" makes E-waste one of the fastest growing waste streams Their treatment, transportation is causing problem of spreading of pollutants in air, water and soil.

Key Words : Toxic Materials, E-waste Including Valuable Metals (Au, Ag, Pt, Cu, Al etc.), Hazardous Components of E-waste, Health Hazards by E-Waste, Pollutants in Air, Water and Soil.

Pages:13 References:22

INTRODUCTION

Since a recent decade, E-waste has been emerged with increase in volume of production and its management. This is due to rapid changes in IT and communication technologies in the way of its generations; acceptance with adaptation as well as rejecting the old technology based electrical and electronic equipments. It has been categorized into three categories. Large household appliances contain Refrigerator and washing machines, IT and Telecom represents personal computer monitor, laptops and Television, radio transistor respectively (CPCB GUIDELINES-2011). The fast growing waste stream is accelerating because the global market for personal computers (PC) is far from saturation and the average life span of a PC is decreasing rapidly[(1)]. A computer contains different types of elements, including 60 % valuable metals (Au, Ag, Pt, Cu, Al etc.) as well as hazardous materials (Cd, Hg, Pb, BFR-Brominated flame-retardants, etc.)[(2)]. These toxic materials are complex and difficult to recycle in an environmentally friendly manner even in developed countries, so these materials generated from the dismantling

of computers are dumped in nearby soil and water and most of waste is transported to developing countries illegally . Land-filling of this waste results in significant contamination of the soil and ground water on properly maintained Landfill and gradually contamination can been seen on the waste land used as informal landfill site while, incineration of waste leads to the release of toxic gases like dioxins and furans [3]. Due to high content of precious metals and high demand for used machines in developing countries like India, obsolete PCs are attractive to informal recyclers. To escape from the cost-effective treatment of this waste to remove the precious metals that needs specific skills and training for the operation. Most of the recyclers currently engaged in recycling activities do not have this expensive technology to handle the waste [4]. Hazardous materials such as lead, mercury and hexavalent chromium in one form or the other are present in such wastes primarily consisting of Cathode ray tubes (CRTs), Printed board assemblies, Capacitors, Mercury switches and relays, Batteries, Liquid crystal displays (LCDs), Cartridges from photocopying machines, Selenium drums (photocopier) and Electrolytes. Although it is hardly known, E-waste contains toxic substances such as Lead and Cadmium in circuit boards, lead oxide and Cadmium in monitor Cathode Ray Tubes (CRTs). Mercury in switches and flat screen monitors; Cadmium in computer batteries, polychlorinated biphenyls (PCBs) in older capacitors and transformers and Brominated flame retardants on printed circuit boards, plastic casings,cables and polyvinyl chloride (PVC) cable insulation that releases highly toxic dioxins and furans when burned to retrieve Copper from the wires. All electronic equipments contain printed circuit boards which are hazardous because of their content of lead (in solder), brominated flame retardants (typically 5-10 % by weight) and antimony oxide, which is also present as a flame retardant (typically 1-2% by weight) (Devi *et. al.,* 2004). .E-waste contributes its presence overall in developed countries about 1% of total solid waste generated at global level on an average, for example, USA accounts 1-3% for generation of e-waste of total generated municipal solid waste (Timothy. G Townsend, 2011).

Moreover, in developing countries an increasing “market penetration” as well as “replacement market” in developed countries and “high obsolescence rate” make E-waste one of the fastest waste streams (UNEP report vol-1. An Inventory Assessment 2007). Since it contains precious metals in and has costly methods and procedures to dispose and dismantelization, developed countries prefer its illegal transportation to developing countries to overcome the problem of bearing costly procedure of dismantelization. As this waste has more tradeable commodity value than other MSW so, mostly western countries transport their 80% E-waste to developing countries that is India, China, and Japan through coastal areas.

The major problem arises by this waste on particularly on human being and other living organisms, which exist at top level in the ecosystem. This waste generates a toxicity of heavy metals which release harmful compounds into the dumping area in the form of latchets. In other words, they are a cause of concern. The problem due to its size, volume and storage. Waste Electrical and Electronic Equipment (WEEE) or E-waste is one of the fastest growing waste streams in the world. There is a pressing need to address E-waste management particularly in developing countries. The presence of valuable recyclable components attracts

informal and unorganized sector. The unsafe and environmentally risky practices adopted by them pose great risks to health and environment. (UNEP report vol-1. 2007). However, many planning and policies have been developed and followed in both Developed and developing countries and guidelines has also for treating the waste by different responsible governmental organizations like UNEP, EPA, CPCB, MoEFCC.

Hazardous components of E-waste

E-Waste contain in itself different types of components in which some are useful as well as some that belong to Hazardous category. Since it is a part of general municipal solid waste but it has different criteria for its treatment. It contains valuable precious metals like Copper (Cu), Aluminum (Al), Gold (Au) and Silver (Ag) are found in their waste over 60% (R.Widmer* *et. al.,* 2005). Although, the guidelines for sound management of E-Waste derived by MoEF (Ministry of Environment and Forestry) reports that more than 1000 different potentially toxic and hazardous substances, such as PVC, PCB, POP (Persistent Organic Pollutants i.e. PAN, Dioxins), which is harmful for human and environment contained in E-waste if these are not properly managed (MoEF guidelines. 2008). During segregation, it is categorized on the basis of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards(PCBs) , concrete and ceramics, rubber and other items (CPCB). E-Waste guidelines. 2011). The different composition of WEEE is found in diverse way in different products. They are categorized mainly Hazardous and Non Hazardous category, Ferrous and Non Ferrous metals, Plywood, Glass, Printed circuit Board, Concrete, Ceramics and more than 1000 substances fall in this categories. (UNEP report vol-1. 2007). Since every material recovered from E-waste is not necessary to be hazardous. For example, ceramic use and cemented plaster used in Air conditioners and refrigerators during making of device but they do not show hazardous activities. However, rest of the metallic and nonmetallic parts used in making devices shows great negative impact on living hood to both flora and fauna in ecological system. In humans, these hazardous materials show both acute and chronic effect when come into direct or indirect contact via different ways. The way of unsafe recycling methods by dismantlers makes it more hazardous than the actual nature of hazardousness to these chemicals and elements because contaminant produced by dispersed in surrounding environment.

Table 4(http://ewasteguide.info/hazardous-substances)

Substance	Occurrence in e-waste
Halogenated compounds:	
PCB (polychlorinated biphenyls)	Condensers, Transformers
TBBA (tetrabromo-bisphenol-A) PBB (polybrominated biphenyls) PBDE (polybrominated diphenyl ethers)	Fire retardants for plastics (thermoplastic components, cable insulation) TBBA is presently the most widely used flame retardant in printed wiring boards and casings.
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam
PVC (polyvinyl chloride)	Cable insulation
Heavy metals and other metals:	
Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes
Barium	Getters in CRT
Beryllium	Power supply boxes which contain silicon controlled rectifiers and x-ray lenses
Cadmium	Rechargeable NiCd-batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)
Chromium VI	Data tapes, floppy-disks
Lead	CRT screens, batteries, printed wiring boards
Lithium	Li-batteries
Mercury	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches
Nickel	Rechargeable NiCd-batteries or NiMH-batteries, electron gun in CRT
Rare Earth elements (Yttrium, Europium)	Fluorescent layer (CRT-screen)
Selenium	Older photocopying-machines (photo drums)
Zinc sulphide	Interior of CRT screens, mixed with rare earth metals
Others:	
Toner Dust	Toner cartridges for laser printers / copiers
Radio-active substances Americium	Medical equipment, fire detectors, active sensing element in smoke detectors

Health hazards by E-Waste

The transportation of heavy metal and spreading of other gaseous pollutant releases through land filling, crushing or leachates form and Incerination cause a great impact on workers and people of nearby area where these waste are dumped or treated. The toxic substances can be found within the following types.

- Leachates from dumping activities.
- Particulate matter (coarse and fine particles) from dismantling activities.
- Fly and bottom ashes from burning activities.
- Fumes from mercury amalgamate "cooking", disordering and other burning activities
- Wastewater from dismantling and shredding facilities.
- Effluents from cyanide leaching and other leaching activities(Sepulveda *et. al.,* 2010)

The major effects are going on workers who are engaged in the treatment process. Various impacts can be seen in the form of cancerous, respiratory and dermal infections, neural and renal disorder. The children, pregnant women and pickers are major influenced by this hazardous waste.

Table 5
Chemicals of primary concern of E-waste (ILO)

Chemical	Source in electronic products	Health concerns
Antimony	CRTs, Printed Circuit boards, etc.	Very hazardous in event of ingestion, hazardous in event of skin and eye contact, and inhalation. Causes damage to the blood, kidneys, lungs, nervous system, liver and mucous membranes (Material Safety Data Sheet, 2005)
Arsenic	Used to make transistors	Soluble inorganic arsenic is acutely toxic and intake of inorganic arsenic over a long period can lead to chronic arsenic poisoning. Effects, which can take years to develop, include skin lesions, peripheral neuropathy, gastrointestinal symptoms, diabetes, renal system effects, cardiovascular disease and cancer (WHO, 2010b)
Barium Short-term	Front panel of CRTs	Short term exposure causes muscle weakness and damage to heart, liver and spleen. It also produces brain swelling after short exposure (Osuagwu & Ikerionwu, 2010)
Beryllium	Motherboards of computers	Carcinogenic (causing lung cancer), and inhalation of fumes and dust can cause chronic beryllium disease or beryllicosis and skin diseases such as warts (Osuagwu & Ikerionwu, 2010)

Cadmium	Chip resistors and semiconductors	Has toxic, irreversible effects on human health and accumulates in kidney and liver (op. cit.). Has toxic effects on the kidney, the skeletal system and the respiratory system, and is classified as a human carcinogen (WHO, 2010c)
Chlorofluorocarbons (CFCs)	In older fridges and coolers	Found to destroy the ozone layer and is a potent greenhouse gas. Direct exposure can cause unconsciousness, shortness of breath and irregular heartbeat. Can also cause confusion, drowsiness, coughing, sore throat, difficulty in breathing, eye redness and pain. Direct skin contact with some types of CFCs can cause frostbite or dry skin (US. National Library of Medicine, n.d.)
Cobalt	Rechargeable batteries and coatings for hard disk drives	Hazardous in case of inhalation and ingestion, and is an irritant of the skin. Has carcinogenic effects and is toxic to lungs. Repeated or prolonged exposure can produce target organs damage (Material Safety Data Sheet,2005)
Copper	Used as a conductor	Very hazardous in case of ingestion, in contact with the eyes and when inhaled. An irritant of the skin and toxic to lungs and mucous membranes. Repeated or prolonged exposure can produce target organs damage (Material Safety Data Sheet, 2005)
Dioxins	Created when electronics are burnt in open air	Highly toxic and can cause chloracne, reproductive and developmental problems, damage the immune system, interfere with hormones and cause cancer (WHO, 2010d)
Gallium	Integrated circuits, optical electronics, etc.	Hazardous in case of skin (may produce burns) and eye contact, ingestion and inhalation. Severe over-exposure can result in death. Toxic to lungs and mucous membranes. Repeated or prolonged exposure

		can produce target organs damage (Material Safety Data Sheet, 2005)
Hexavalent chromium	Used as corrosion protection of untreated and galvanized steel plates and a decorator or hardener for steel housings (Osuagwu & Ikerionwu, 2010)	Damages kidneys, the liver and DNA. Asthmatic bronchitis has been linked to this substance (Osuagwu & Ikerionwu, 2010). Causes irritation of the respiratory system (asthma) and skin, liver and kidney damage, increased or reduced blood leukocytes, eosinophilia, eye injury, and is a known carcinogen (lung cancer).
Indium	LCD screens	Can be absorbed into the body by inhalation or ingestion. Is irritating to the eyes and respiratory tract and may have long-term effects on the kidneys. Environmental effects have not been investigated and information on its effects on human health is lacking; therefore utmost care must be taken (ICSC database, n.d.)
Lead	Solder of printed circuit boards, glass panels and gaskets in computer monitors (Osuagwu &Ikerionwu, 2010)	Causes damage to central and peripheral nervous systems, blood systems and kidneys, and affects the brain development of children (Osuagwu & Ikerionwu, 2010). A cumulative toxicant that affects multiple body systems, including the neurological, hematological, gastrointestinal, cardiovascular and renal systems (WHO, 2010e)
Lithium	Rechargeable batteries	Extremely hazardous in case of ingestion as it passes through the placenta. It is hazardous and an irritant of the skin and eye, and when inhaled. Lithium can be excreted in maternal milk (Material Safety Data Sheet,2005)
Mercury	Relays, switches and printed circuit	Elemental and methyl-mercury are toxic to

	boards (Osuagwu & Ikerionwu, 2010)	the central and peripheral nervous system. Inhalation of mercury vapour can produce harmful effects on the nervous, digestive and immune systems, lungs and kidneys, and may be fatal. The inorganic salts of mercury are corrosive to the skin, eyes and gastrointestinal tract, and may induce kidney toxicity if ingested (WHO, 2007)
Nickel	Rechargeable batteries	Slightly hazardous in case of skin contact, ingestion and inhalation. May be toxic to kidneys, lungs, liver and upper respiratory tract. Also has carcinogenic effects (Material Safety Data Sheet, 2005)
Perfluorooctane sulfonate PFOS/F)	Photoresistant and anireflectant coating	Persistent, bioaccumulative and toxic to mammalian species; linked to increases in the incidence of bladder cancer (OECD, n.d.)
Phthalates	Used to soften plastics	Disrupts the endocrine system, reproduction, fertility and birth, and has developmental effects. Also has organ system toxicity and is linked to liver cancer and effects on the brain, nervous system and immune system (Environmental Working Group, n.d.)
Polybrominated diphenyl ethers (PBDEs)	Used in brominated flame retardants (BFRs) Plastic housing of electronic equipments and circuit boards to reduce flammability (Tsydenova & Bengtsson, 2011)	PBDEs are of concern because of their high lipophilicity and high resistance to the degradation processes. Hepatotoxicity, embryo toxicity and thyroid effects seem to be characteristic endpoints in animal toxicity, and behavioral effects have been demonstrated (Darnerud, Eriksen, Jóhannesson, Larsen, & Vileksela. 2001). BFRs in general have been shown to disrupt endocrine system functions and may have an effect on the levels of thyroid stimulating hormone and cause genotoxic damage, causing high cancer risk (Tsydenova & Bengtsson, 2011)
Polychlorinated biphenyls (PCBs)	Insulating material in older electronic products	Linked to reproductive failure and suppression of the immune system (Stockholm Convention, n.d.)

Polyvinyl Chloride (PVC)	Cabling and computer housing plastics contain PVC for its fire-retardant properties	Produces dioxins when burnt; causes reproductive and developmental problems, immune system damage and interferes with regulatory hormones (Osuagwu & Ikerionwu, 2010)
Silver -	Wiring circuit boards, etc	Very hazardous in case of eye contact, ingestion and inhalation. Severe over-exposure can result in death. Repeated exposure may produce general deterioration of health by an accumulation in one or many human organs (Material Safety Data Sheet, 2005)
Thallium -	Batteries, semiconductors, etc	Very hazardous in case of ingestion and inhalation. Also hazardous in case of skin and eye contact. May be toxic to kidneys, the nervous system, liver and heart, and may cause birth defects. Severe over-exposure can result in death (Material Safety Data Sheet, 2005)
Tin	Lead-free solder	Causes irritation in case of skin and eye contact, ingestion and inhalation. Can cause gastrointestinal tract disturbances, which may be from irritant or astringent action on the stomach (Material Safety Data Sheet, 2005)
Zinc (chromates)	Plating material.	Contact with eyes can cause irritation; powdered zinc is highly flammable (University of Oxford, 2005); if inhaled, causes a cough, and if ingested, abnominal pain, diarrhea and vomiting is common (ICSC database, n.d.)

POLICIES, GUIDELINES AND LEGISLATIVE INITIATIVE AT NATIONAL AND INTERNATIONAL LEVEL

Many countries has been developing the policies and guidelines to measure and mitigate the burgeoning increase in E-waste. Different organization and institutions has put their effort to minimize the problem of e-waste and they have developed legistive initiatives also to amend in effective way. These illegal exports and imports or transboundary movements of this waste is due to containing precious metals in itself as well as to overcome the problem of proper recycling of these waste which is not cost effective to the recycler.

EU (European Union) who defined and gave the term E-waste made first guidelines. E-Waste or WEEE (Waste Electrical Electronic Equipments) and European Union (EU) coined this term. According to the EU definition, EEE are those devices which generates, transfer, measurements the such currents that designed for bear the voltage of 1000 volts for alternative currents and 1500 volts for Direct current and their categories are set out in Annex IA to Directive 2002/96/EC (WEEE) (Directive 2002/96/EConWEEE.,2003).

Basal convention covers all wide range of waste materials that poses hazardous activities in nature. Annex viii covers all e-waste, which is considered as hazardous under art.[1], Para. One (a) of the convention, as following:

- **A 1010:** Antimony, Arsenic, Beryllium, Cadmium, Lead, Mercury, Selenium, Tellurium, Thallium.
- **A 1020:** metal compounds associated from e-waste.
- **A 1030:** Wastes having as Arsenic; arsenic compounds, Mercury; mercury compounds, Thallium; Thallium compounds .
- **A 1090:** Ashes from the incineration of insulated copper wire.
- **A 1150:** Precious metal ash from incineration of printed circuit boards not included on list B.
- **A 1170:** Unsorted waste batteries excluding mixtures of only list B batteries; waste batteries not specified on list B containing Annex I constituents to an extent to render them hazardous
- **A 1180:** Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III. Annex IX contains the mirror entry,
- **B 1110:** Electrical and Electronic Assemblies, which is given here:Electronic assemblies consisting only of metals or alloys. Waste electrical and electronic assemblies or scrap (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury-switches , glass from cathode-ray tubes and other activated glass and PCB-capacitors, or not contaminated with Annex 1.
- **A 1190:** Waste metal cables coated or insulated with plastics containing or contaminated with coal tar, PCB1,

lead, cadmium, other organohalogen compounds or other Annex I constituents to an extent that they exhibit Annex III characteristics.

- **A 2010:** Glass waste from cathode-ray tubes and other activated glasses. (UNEP Report VOL-III 2012.Regulation at other countries.

INDIA

E-waste (Management and Handling) Rules, 2011, dated May 2011, came into effect on 1 May 2012. Under this regulation, E-waste is defined as "waste electrical and electronic equipment whole or in part included in, but not confined to, equipment listed in Schedule 1 and scraps or rejects from their manufacturing process, which is intended to be discarded." "Electrical and electronic equipment (EEE)" means equipment that is dependent on electric currents or electromagnetic fields to be fully functional, including those used for generation, transfer and measurement of such currents and fields falling under the categories set out in Schedule 1. There are two categories of EEE in Schedule 1, consisting of 18 items as described in Schedule 2.

SWITZERLAND

Switzerland was the first country in the world where e-waste management system at national level was established and operated [D.Sinha et al. 2005]. (Ordinance on "The Return, the Taking Back and the Disposal of Electrical and Electronic Appliances") (The OREDA law introduced for e-waste management as for legislation [R.widmer etal.2005]. There are two different e-waste recycling systems are working in the country named as SWICO Recycling Guarantee (The Swiss Association for Information, Communication and Organizational Technology) that manages the "brown" electronic equipment (e.g. computers, televisions, radios, etc.), and the other is S.EN.S (Stiftung Entsorgung Schweiz System) and manages the "white" electrical equipment (e.g. washing machines, refrigerators, ovens, etc.) [D.Sinha *et. al.,* 2005].

JAPAN

The two major laws cover a broad range of E- Waste items; the first law defines the recycling of Home appliances denoted as "Home Appliances Recycling Law", 1998. This law covers TVS, Refrigerators and Freezers, Washing machines, Dryers and Air conditioners. The other law is "Law for promotions of the Effective Utilization of Resources", enacted in 2000 and E- waste covers all "used good and by products" under this law. This law covers personal computers (for home and office) and other electronic items. According to this law, "used goods," means any articles that are collected, used or unused, or are disposed of (except radioactive materials or those contaminated thereby). "By-products" means any articles obtained secondarily in the processes of manufacturing, processing, repairing or selling a product, in the process of supplying electricity, or in the process of construction pertaining to architecture and civil engineering (referred to as "construction work") except radioactive materials or those contaminated thereby. (UNEP report vol III. 2012).

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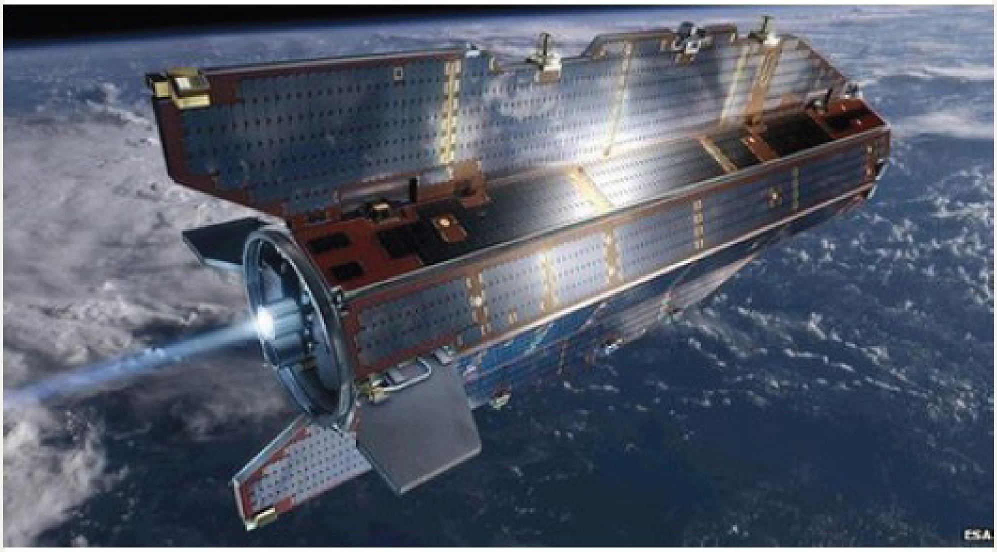
European Space Agency's Goce satellite falls to Earth



Goce needed its engine power to stay in orbit

Prof. T.R.C Sinha a true lover of science and always concerned about the environment. It was his dream to publish scientific journals and he started this project with the same enthusiasm as he had done for every project he undertook. We are guided by the vision of Prof. Sinha and endeavour to make his dream of promoting science and help young scientists, publish their articles and encourage them in their research.

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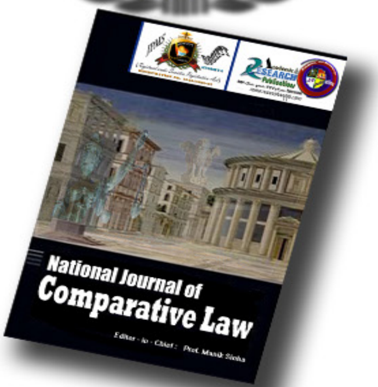

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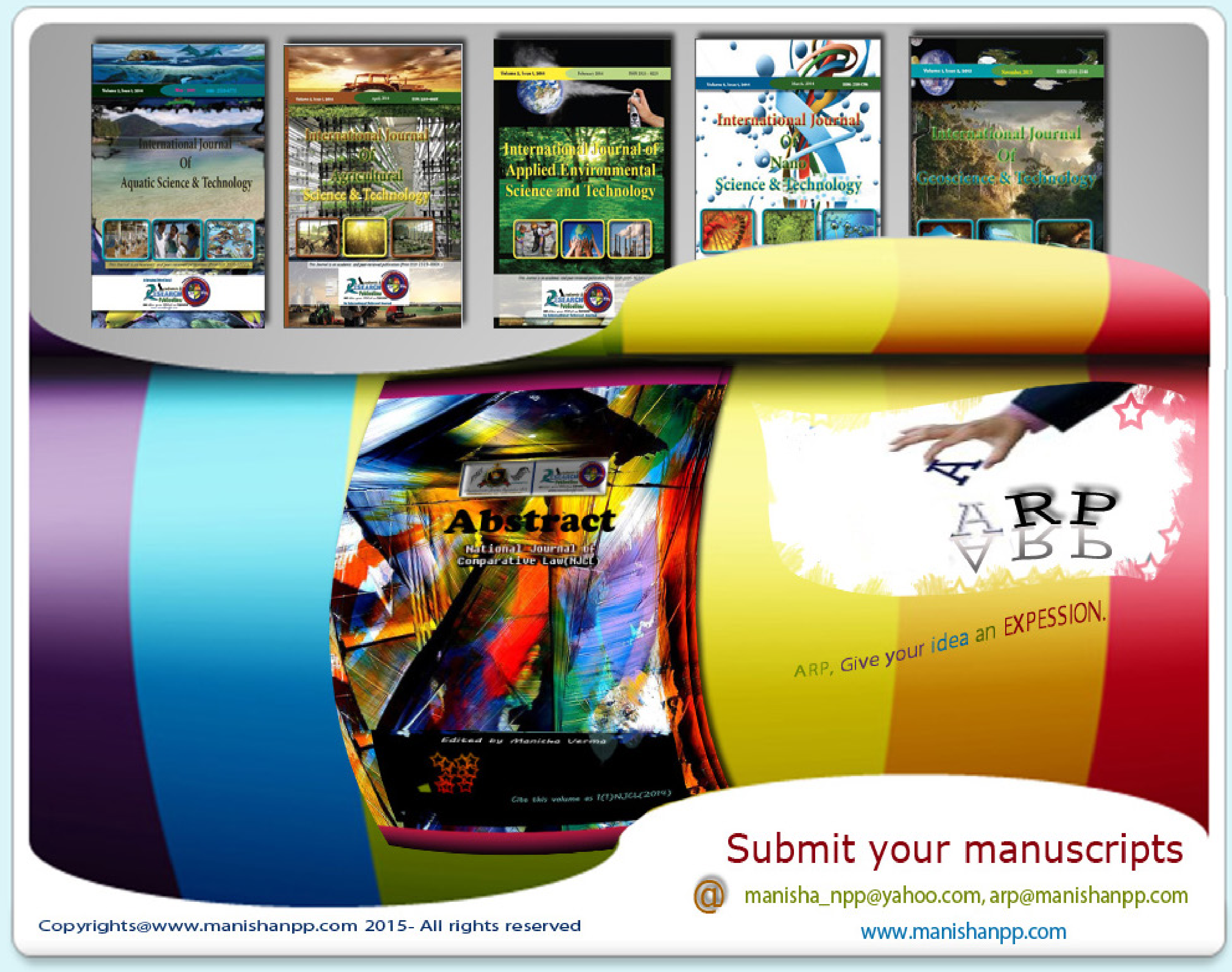

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